1,096,269

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,096,269

Date of Application and filing Complete Specification: Aug. 2, 1965.
No. 32932/65.
Application made in France (No. 984530) on Aug. 7, 1964.
Complete Specification Published: Dec. 20, 1967.

Index at acceptance: —G1 J(2C2A, 2D1); B3 V4A1

Int. Cl.: —G 01 d 15/08

COMPLETE SPECIFICATION

A Method and a Device for Marking Materials

We, INSTITUT DE RECHERCHES DE LA SIDERURGIE FRANCAISE, of 185, rue President Roosevelt, Saint Germain-en-Laye (Seine-et-Oise) France, a body corporate of France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the marking of materials in which flaws or defects have been observed.

Methods are already known consisting in marking with a grease or coloured pencil the spots where flaws are found in a material under inspection; methods are also known in which the defects in a material under examination are marked with a spot of paint.

These methods using mechanical means usually have rather a long response time; moreover, if the material under examination is coated with a foreign substance such as oil, marking becomes very difficult, and the marks are very rapidly effaced. It may also happen, particularly if a liquid marking substance is used, that sound material is contaminated by the liquid applied to the defective parts.

The object of the present invention is to reduce these inconveniences and to obtain a clear and lasting marking on the surface of a material under examination in which flaws have been detected; and more particularly, on material moving under a flaw detecting device or instrument.

The present invention is a method of marking a material under test in which flaws have been detected, in which an electrical discharge is produced automatically on or near the surface of the material under test by which the latter is marked with an indelible imprint and that the said electrical discharge is released by signals indicating the presence of defects in the said material under test.

The method as described below may further incorporate at least one of the following features:—

a. The said discharge is released between such material and an electrode carrying a high potential.

b. The said discharge is released between an earth and an electrode carrying a high potential.

c. The said signals are released through the intermediary of a non-destructive testing apparatus.

d. The said signals are emitted through the intermediary of an ultrasonic testing head.

The present invention further provides apparatus for marking a material under test in which flaws have been detected, comprising a device signalling the presence of defects in the material in combination with a marking device, the said marking device including an electrode held by guiding means at a fixed distance from the material the said guiding means being connected in an electric circuit at low tension with which there is connected in parallel, a high-frequency electric circuit.

The present invention may further incorporate at least one of the following features in combination with the preceeding:—

a. The said apparatus for signalling faults comprises an electrical generator, one or more transducers for the purpose of converting the said electric pulses into ultrasonic pulses to be transmitted to the said material under test and of generating electric pulses in response to the energy of the ultrasonic waves received from the said material under test as well as suitable means for selecting from the electric signals those which indicate the presence of flaws or defects in the said material under test.

b. The said electrode is of graphite.

[Price 4s. 6d.]

c. The said electrode is of metal.

d. The said guiding means comprises an electrically-insulating electrode support and incorporate an element capable of rolling on such material under test.

The manner of action of the method described above by which the marking of defective materials is performed instantaneously by the action of sparks on the material under test, is easily appreciated. The emission of an electric discharge in fact produces on the material to be marked, a clear and indelible imprint without, however, impairing its useful qualities; this marking remaining effective whatever the temperature and the travelling speed of the material under test. The method is likewise applicable to soiled surfaces, e.g. those soiled by the presence of oil or oxide,—which will, in fact, merely increase the clarity of the indication.

The method in accordance with the invention is applicable to any process of non-destructive materials testing, e.g. electrical probing, magnetic, or ultrasonic detection.

The energy necessary for the generation of the marking sparks is obtained from a high-current, low-tension electric arc discharge, while the release of the spark is triggered by a high-frequency current producing an initiating spark. By using such a high frequency current it is possible to use only a low-power circuit to control the marking operation.

The low-tension current may be direct or alternating; the use of alternating current, however, presents the advantage of furnishing markings which are spaced in accordance with the travelling speed of the material under inspection.

The mark thus applied to the material has an easily recognisable, characteristic regularity of appearance, and is perfectly distinguishable from small, fortuitous irregularities which may be present on the surface of the material under test.

The electric power applied is directly proportional to the rate of passage of the material under the testing appliance, it is thus possible to mark materials travelling at a high speed of the order of several metres per second provided a low-tension current of the necessary intensity is available.

One device according to the present invention consists of an electrode in the form of a pencil of some conducting material such as graphite or metal, held at a short distance from the test piece by means of an electrically insulating holder; this electrode being connected to one terminal of the electric circuit described above and being held at a constant distance from the tested material by means of a roller or wheel attached to the electrode holder and connected with the other terminal of the electric circuit.

This invention is equally applicable to conducting or non-conducting materials. In the first case, the marking spark passes between the electrode and the tested material; in the second case, the discharge is made between the insulated electrode and the mass of the support or holder, e.g. the roller maintaining a constant distance between the electrode and the test piece.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 shows the general arrangement of a device in accordance with the present invention;

Fig. 2 is a detail view of the marking apparatus properly speaking.

Fig. 1 shows the general arrangement of a device for marking products scanned while travelling rapidly in front of a flaw-detecting apparatus.

A graphite electrode 1 is connected to one terminal of a double electric circuit comprising in parallel, a low frequency circuit at a tension of 220 volts, and a high-frequency circuit 3. The circuit 2 includes an isolating transformer 4, a resistance 5 for current limiting and surge chokes as shown at 6a and 6b. To the terminals of circuit 2 there is connected the circuit 3, comprising a transformer 7 with 5000 volts secondary output and the relay 8 of a signalling device for an ultrasonic inspection instrument, these two, known devices not being shown. In series with the transformer, surge chokes 9 and 10 are connected, followed by a high-frequency spark gap 11, condensers 12 and 13 being connected in parallel with the circuit 3; the high frequency transformer 14 and condensers 15 and 16 completing the circuit 3, which is connected back to the circuit 2. The other terminal of the double circuit is earthed on the holder 17 insulating the electrons 1 which is held by a roller 18 at a fixed distance from the material under test 19.

It will easily be appreciated that this device makes it possible to produce a spark between two adjacent points such as the electrode 1 and the material under test 19. If the latter is a conductor, the current is transmitted through the conducting material to be marked. If the material is not conducting, the mass of the roller connected in the electric circuit is sufficiently near to enable a spark to be produced and impress an indelible mark on the test piece.

Fig. 2 shows in more detail, the marking apparatus itself. This consists of a support or holder 17 comprising a tube 20 of steel, which is fixed on a plate 21, a stirrup 22 carrying the roller 18, and the pencil 1 of graphite, electrically insulated from the support 17. The pencil is connected to one terminal of the double electric circuit, while the support is connected to the other terminal.

It is to be understood that the embodiments which have been described above are merely exemplary without any restriction and that it is possible to conceive of many variants and improvements in detail as well as to envisage the use of equivalent means without thereby exceeding the scope of the present invention.

WHAT WE CLAIM IS:—

1. A method of marking a material under test in which flaws have been detected, in which an electrical discharge is produced automatically on or near the surface of the material under test by which the latter is marked with an indelible imprint and that the said electrical discharge is released by signals indicating the presence of defects in the said material under test.

2. A method as claimed in claim 1, in which the said discharge is released between the said material under test and an electrode carrying a high potential.

3. A method as claimed in claim 1, in which the said discharge is released between an earth and an electrode carrying a high potential.

4. A method as claimed in Claim 1, in which the said signals are emitted through the intermediary of a non-destructive testing device.

5. A method as claimed in claim 1, in which the said signals are emitted through the intermediary of an ultrasonic testing device.

6. Apparatus for marking a material under test in which flaws have been detected, comprising a device signalling the presence of defects in the material in combination with a marking device, the said marking device including an electrode held by guiding means at a fixed distance from the material the said guiding means being connected in an electric circuit at low tension with which there is connected in parallel, a high-frequency electric circuit.

7. A device as claimed in claim 6, in which the said electrode is of graphite.

8. A device as claimed in claim 6, in which the said electrode is of metal.

9. A device as claimed in claim 6, in that the said guiding means consist of an electrically insulating support for the said electrode comprising an element rolling on the said material under test.

10. A method of marking a material under test in which flaws have been detected, substantially as hereinbefore described with reference to in the accompanying drawing.

11. Apparatus for marking a material under test in which flaws have been detected, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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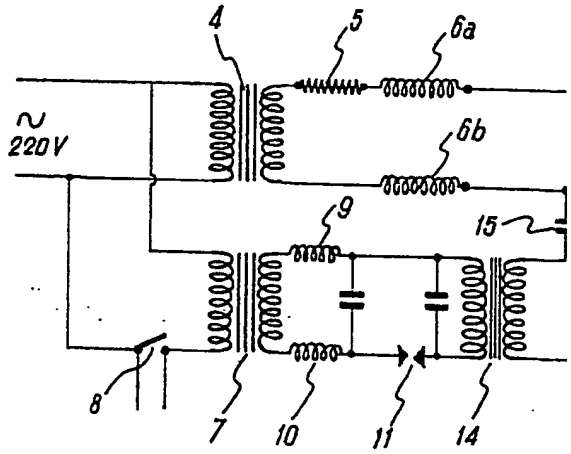
3, Gray's Inn Square, London, W.C.1.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1967.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.



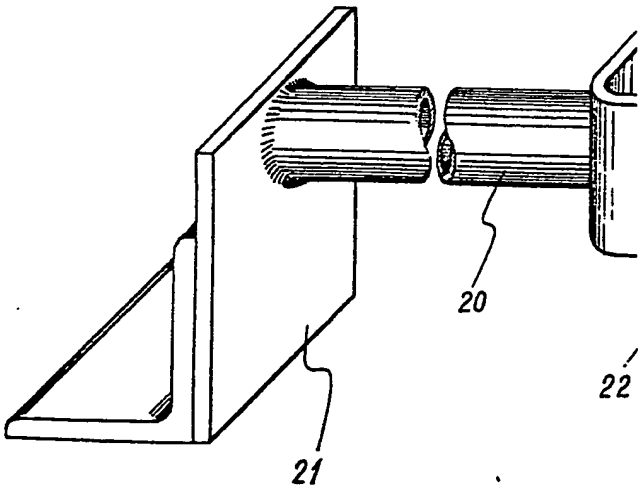


Fig.2

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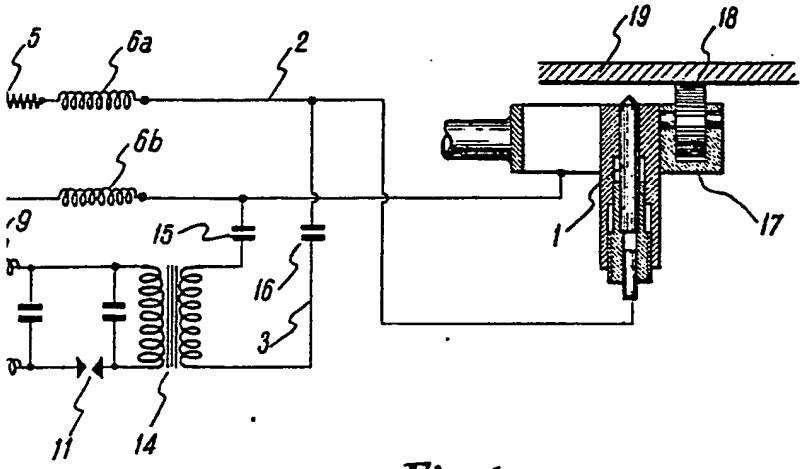
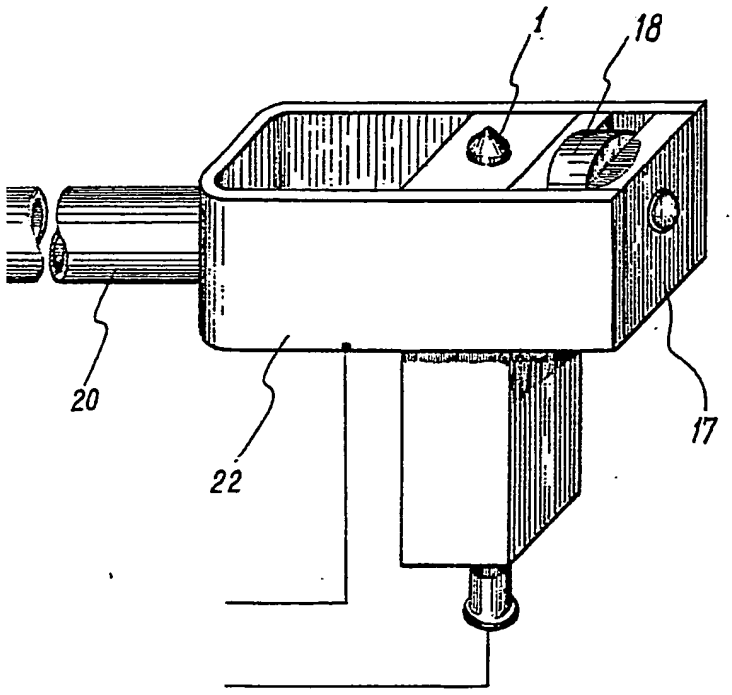


Fig.1



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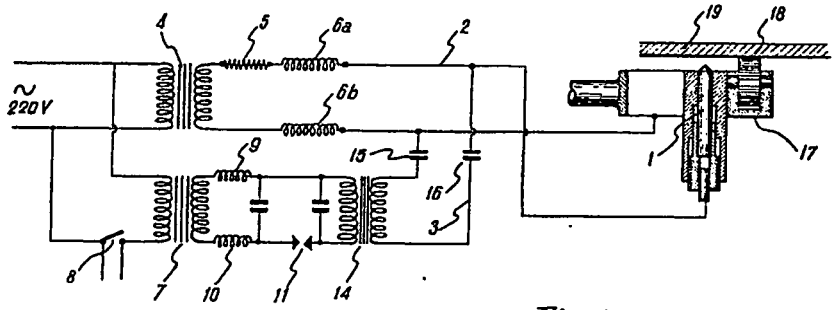

Fig.1

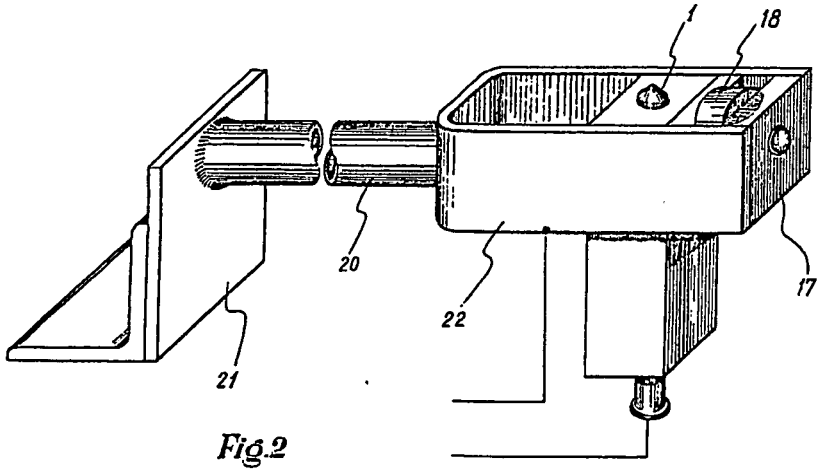

Fig.2